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(54) **Webbing retractor**

(57) A webbing retractor for a vehicle seatbelt includes a webbing take-up shaft locked when lag in rotation between locking wheel (50) and the shaft occurs in an emergency, the locking wheel also being acted on by an acceleration sensor (62). Opposed to the locking wheel (50) is a pivoted arm (84) which can be biased selectively towards or away from the locking wheel in accordance with a webbing-winding or unwinding amount.

Accordingly, the webbing retractor can be used as an Automatic Locking Retractor and an Emergency Locking Retractor.

The biasing of the arm (84) can be controlled either (Figure 2) by a projection (80) on a ring (70) rotated by the take-up shaft through reduction gearing (64,68) or (Figure 9) by a lever (90) which engages the webbing wound on the shaft.

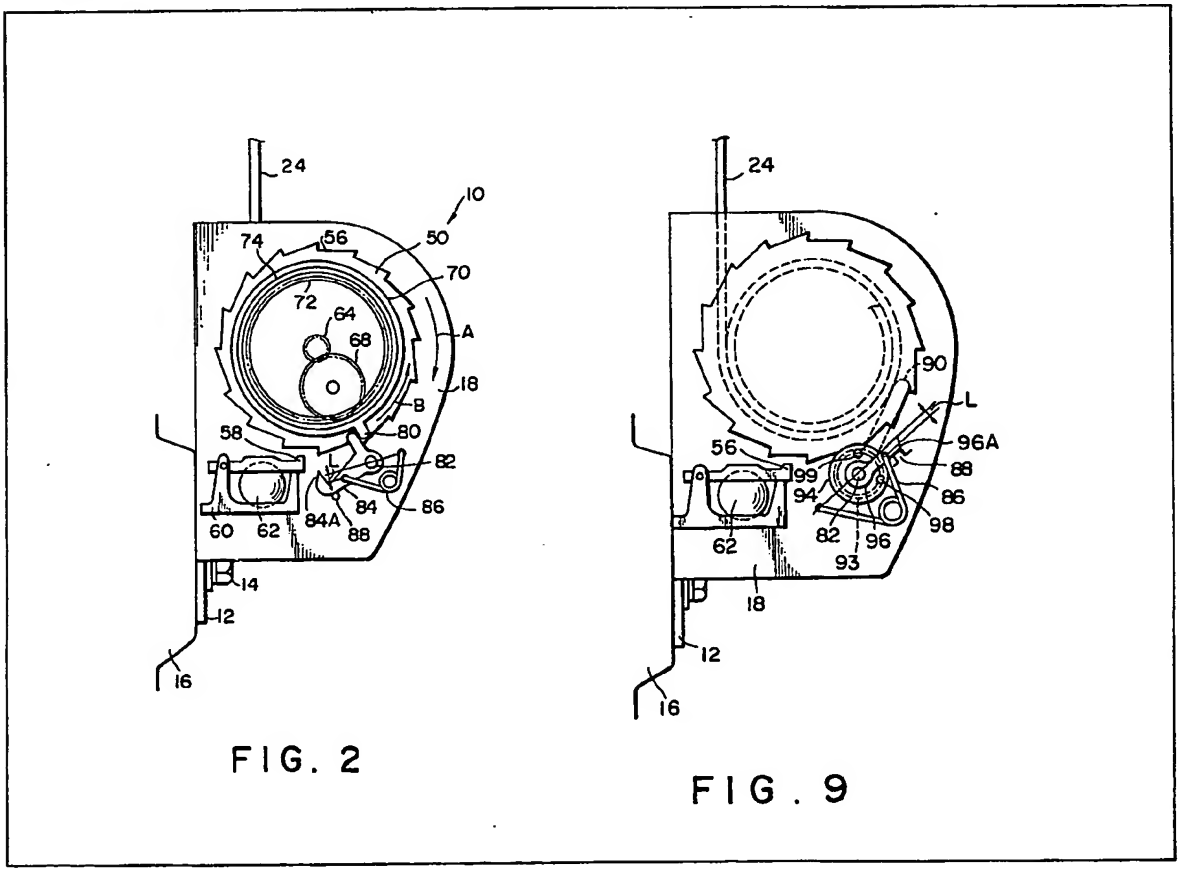

FIG. 2

FIG. 9

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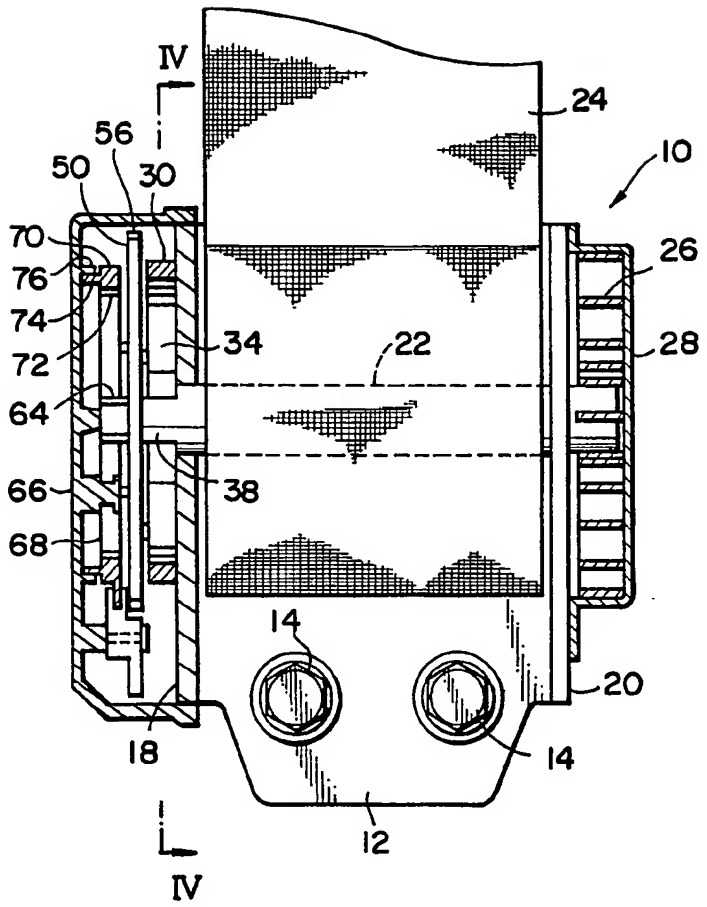

FIG. 1

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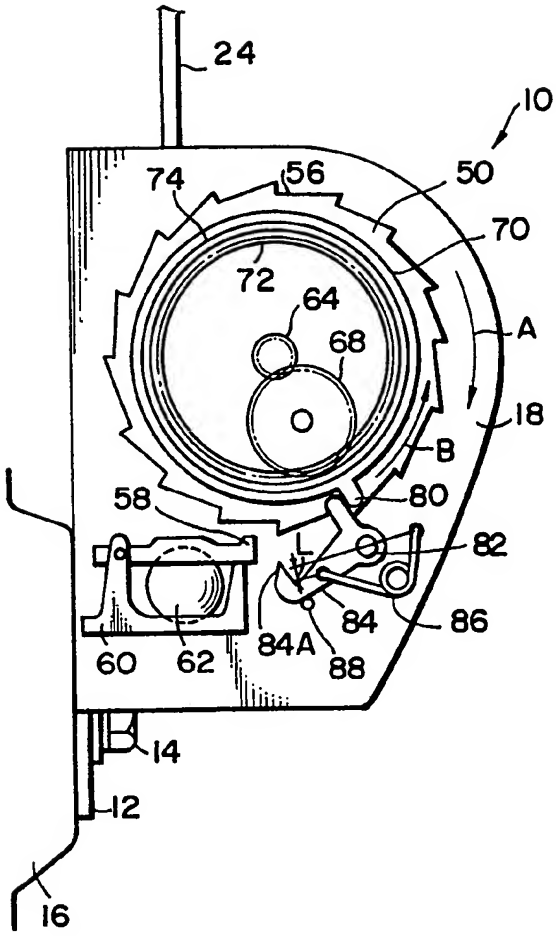

FIG. 2

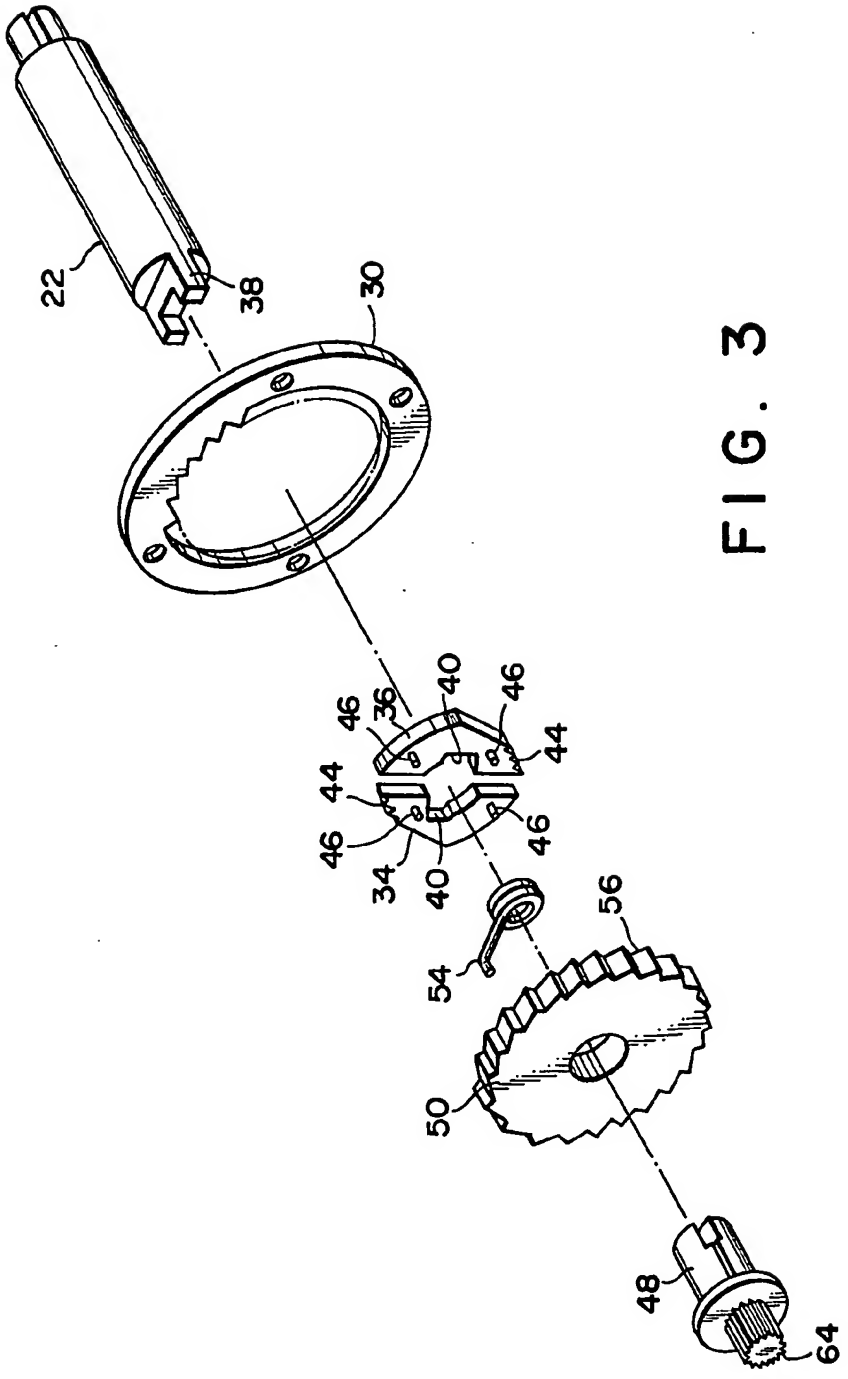

FIG. 3

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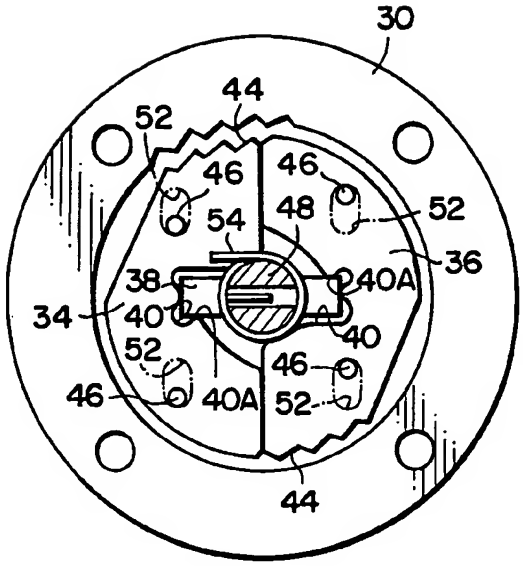

FIG. 4

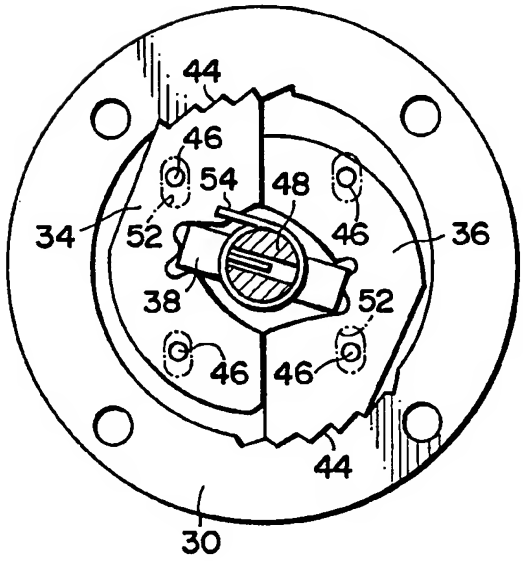

FIG. 5

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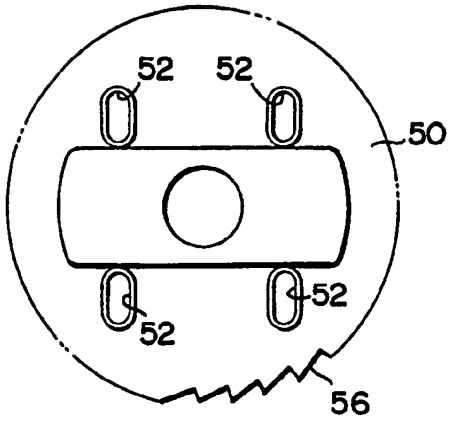

FIG. 6

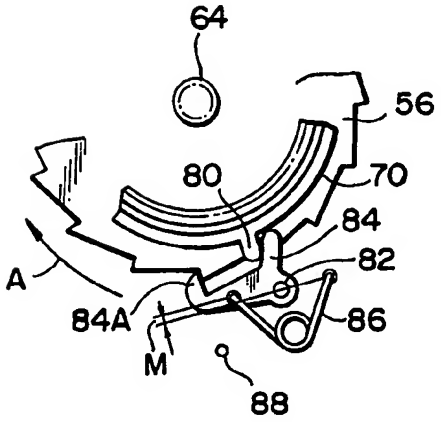

FIG. 7

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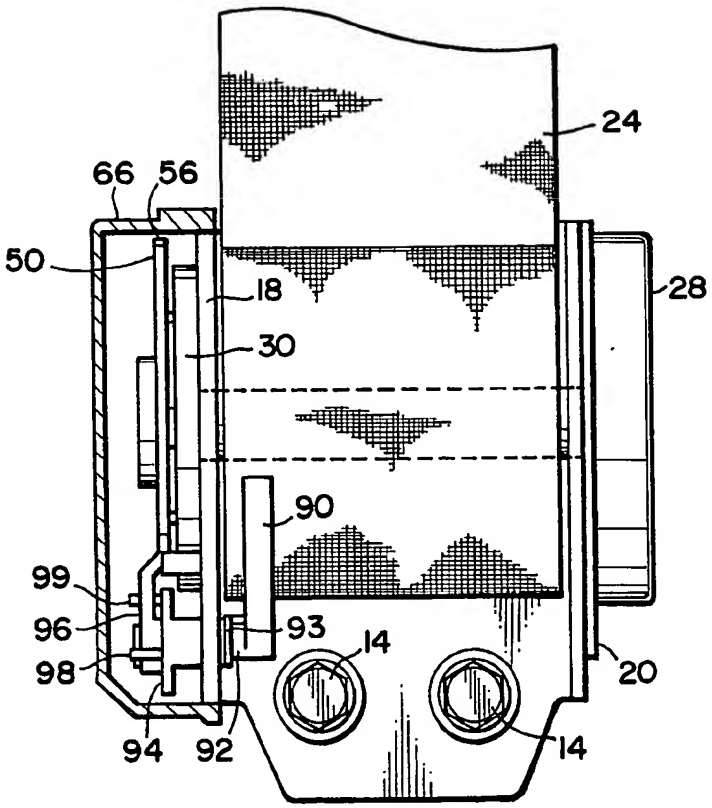

FIG. 8

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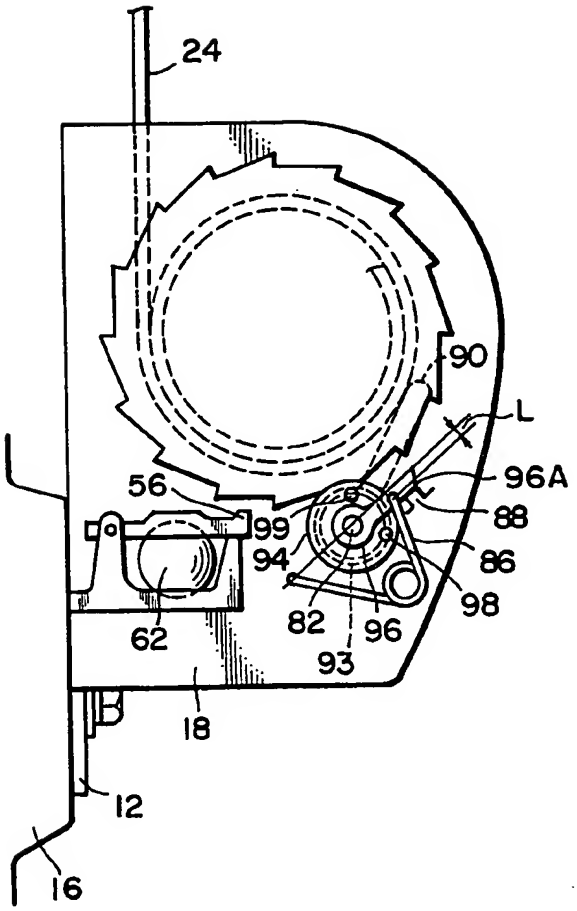

FIG. 9

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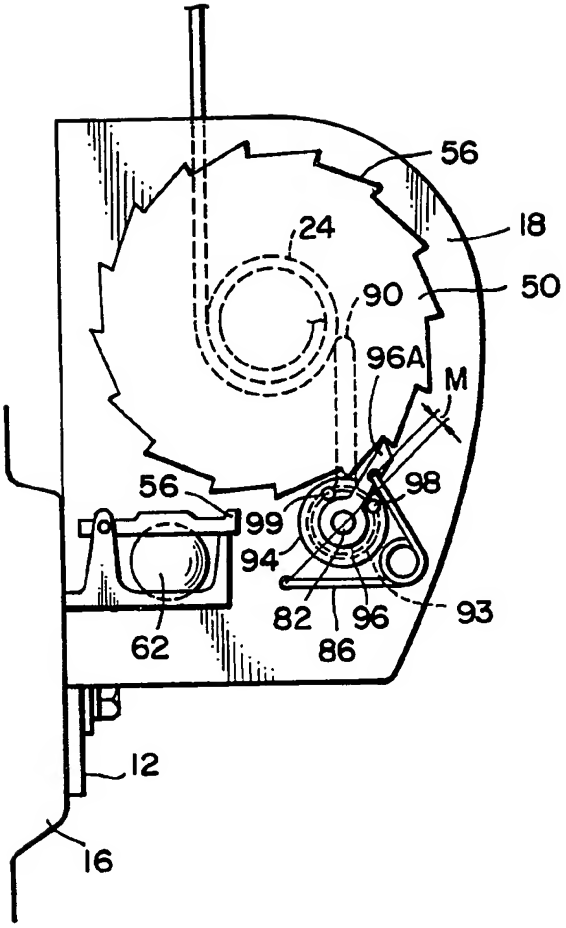

FIG. 10

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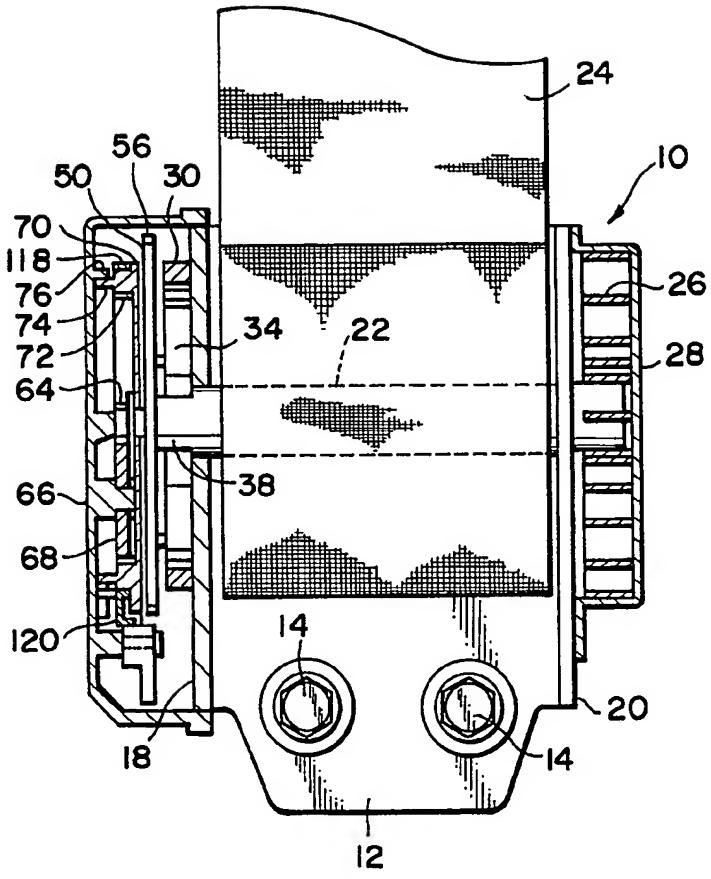

FIG. 11

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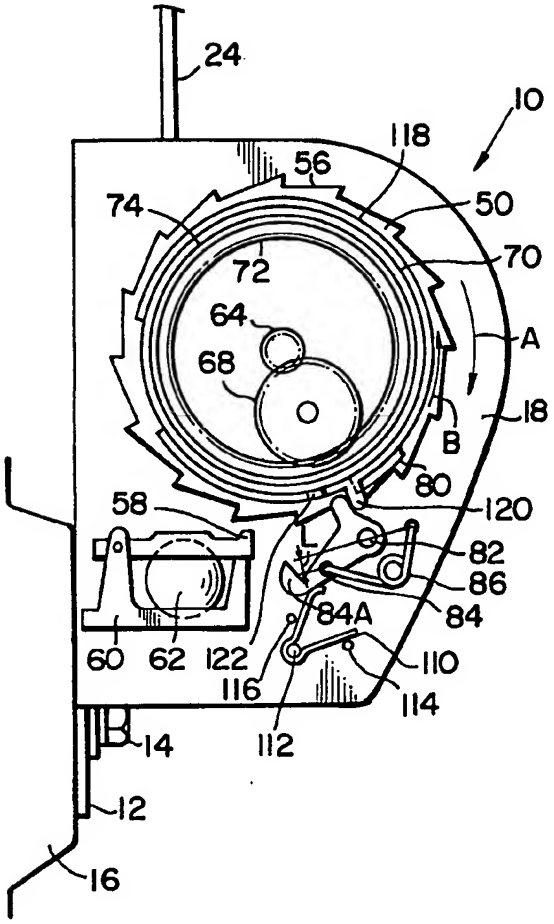

FIG. 12

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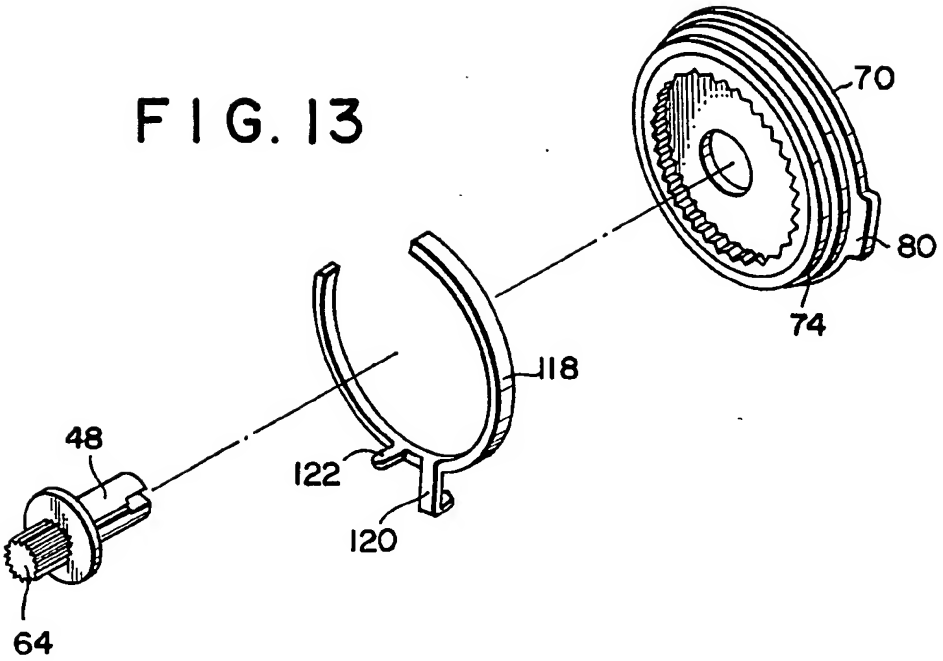
FIG. 13



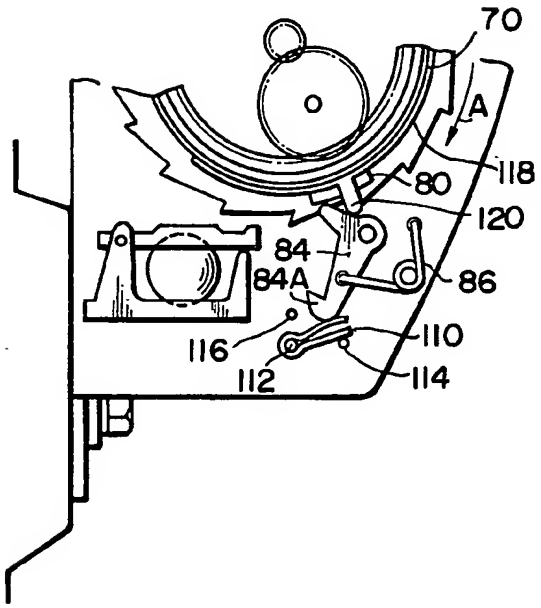
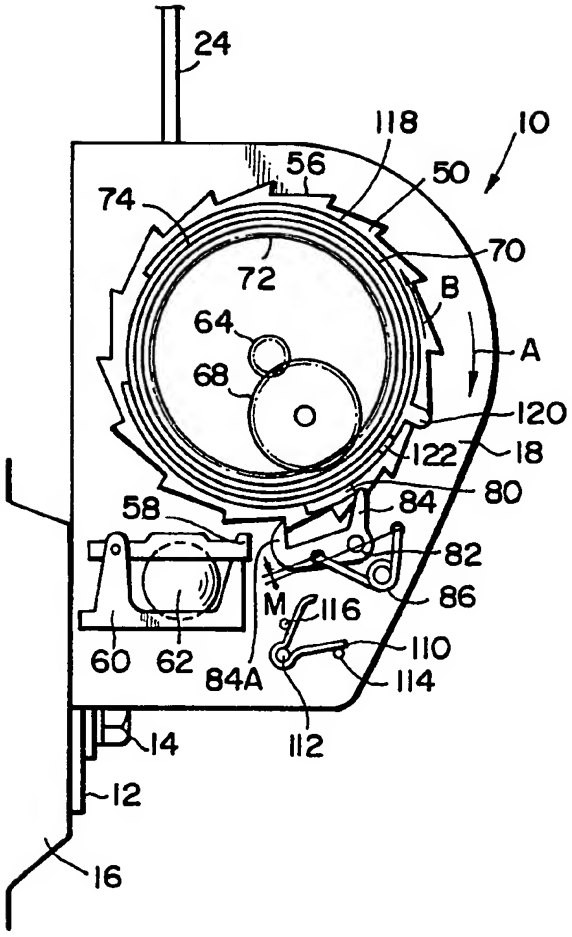


FIG. 14


24
118
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56
50
74
70
72
B
64
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68
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122
18
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86
M
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110
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84A
114
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FIG. 15

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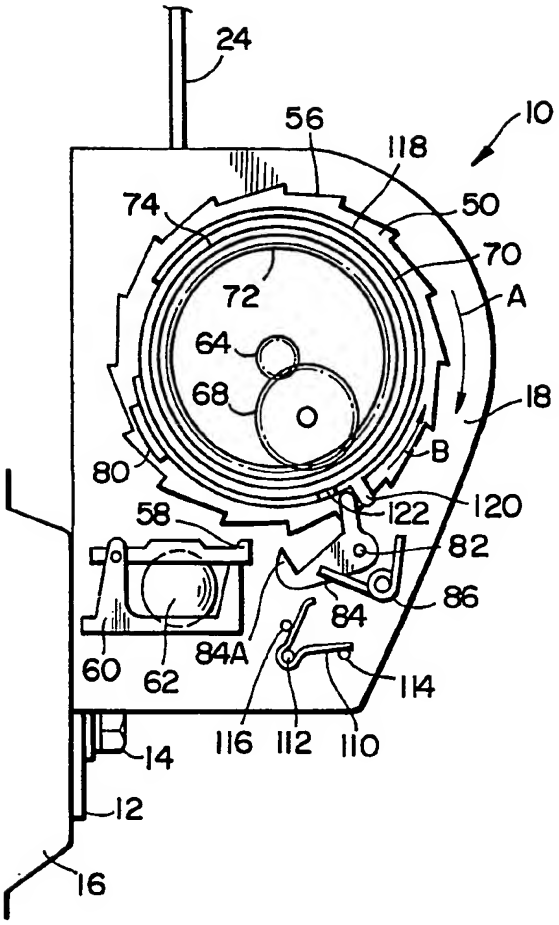

FIG. 16

SPECIFICATION

Webbing retractor

The present invention relates to a webbing retractor for recoiling the restraining webbing of a vehicle seatbelt system in an emergency situation.

The webbing retractor, applied to the seatbelt system for protecting the occupant of the vehicle to wind the end portion of the occupant restraining webbing, is constructed so as to wind or recoil the webbing by a biasing force and store it therein.

Among such webbing retractors, in a webbing retractor provided with an automatic locking mechanism for automatically stopping unwinding of the webbing after the occupant wears the webbing, so-called Automatic Locking Retractor (ALR), the occupant is always restrained securely by the webbing, so that he is made it difficult to change his attitude.

Also, in a webbing retractor provided with an emergency locking mechanism for stopping the unwinding of the webbing when an emergency situation of the vehicle is detected by an acceleration sensor, so-called Emergency Locking Retractor (ELR), the occupant can change his attitude easily in the ordinary running situation of the vehicle but, in case that a baggage, a vessel for receiving a child or the like is fixed to a seat of the vehicle by the webbing, it is moved sometimes. That is to say, the webbing is unwound unnecessarily from the webbing retractor by a vibration or the like due to a low acceleration range where the acceleration sensor is not worked or the movement of the child received in the vessel, so that the baggage, the vessel or the like is moved on the seat. In addition, the ELR is provided with a manual locking mechanism for manually locking the emergency locking mechanism to stop the webbing unwinding and rotating the take up shaft as required has been proposed in this field. However, such a manual locking mechanism is generally mounted on the webbing retractor as an optional part and, therefore, an operation lever for the manual locking mechanism must be arranged at the small space where the lever is difficult to be operated, for example, under the seat, whereby the operation of the lever is complicated. Also, in order to remote-control the manual locking mechanism such a connecting means as a wire must be arranged in the vehicle body.

The present invention has as its object the provision of a webbing retractor which is able to be used as an ALR or an ELR as required.

In the webbing retractor according to the present invention, an acceleration sensor gives a rotation-resistance to a locking wheel so as to prevent a webbing from being unwound from a take up shaft in an emergency situation of a vehicle, and in an ordinary running situation of the vehicle a control means is biased so as to separate from the locking wheel when the winding amount of the webbing exceeds a predetermined value and is biased so as to approach the locking wheel when the unwinding amount of the webbing exceeds another predetermined value.

The invention will now be described further by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a front view showing a webbing retractor of a first embodiment of the present invention;

figure 2 is a left side view of the webbing retractor shown in Figure 1 from which a cover is removed;

Figure 3 is a disassembled perspective view of a main portion of the webbing retractor shown in Figure 1;

Figure 4 is a front view showing a locking plate and the structure relating thereto corresponding to a sectional view taken along the line IV - IV in Figure 1;

Figure 5 is an operational view of Figure 4;

Figure 6 is a reverse side view of a locking wheel;

Figure 7 is an operational view of Figure 2;

Figure 8 is a front view showing a webbing retractor of a second embodiment of the present invention corresponding to Figure 1;

Figure 9 is a left side view of Figure 8 corresponding to Figure 2;

Figure 10 is an explanation view of the operation condition of Figure 9;

Figure 11 is a front view showing a webbing retractor of a third embodiment of the present invention corresponding to Figure 1;

Figure 12 is a left side view of the webbing retractor shown in Figure 11 from which a cover is removed;

Figure 13 is a disassembled perspective view of a part of the webbing retractor shown in Figure 12;

Figure 14 is an operational view of Figure 12 showing a maximum winding condition of a webbing;

Figure 15 is an operational view of Figure 12 showing the condition that the webbing retractor functions as an ALR; and

Figure 16 is an operational view of Figure 12 showing the condition that the webbing is wound.

As shown in Figures 1 and 2, a webbing retractor 10 according to a first embodiment of the present invention is fixed at its frame 12 to a vehicle body 16 through fitting bolts 14.

A pair of leg plates 18, 20 extend from both the side portions of the frame 12 in parallel with one another and both the end portions of a takeup shaft 22 is rotatably supported by them. Wound in layers on to a central portion of the takeup shaft 22 is one end of an occupant-restraining webbing 24, the other end of which is fixed to another part of the vehicle body through a tongue-plate, a buckle unit or the like, not shown, whereby an intermediate portion of the webbing 24 can be worn by an occupant.

The end portion of the takeup shaft 22 penetrating the leg plate 20 is engaged with an inner end of a spiral spring 26, the outer end of which is engaged with a spring case 28 fixed to the leg plate 20. The takeup shaft 22 is biased in the wound, or retracted, direction of the webbing 24 by the spiral spring 26.

Fixed to the outer face of the leg plate 18 through a plurality or rivets is an internal gear ratchet wheel 30. Opposed to the internal gear of the internal gear ratchet wheel 30 are a pair of lock plates 34, 36, as shown in Figures 3 and 4. The lock plates 34, 36 are

formed at the central portions thereof with recesses 40, respectively, for receiving rectangular projection 38 as being radial projection of the takeup shaft 22, whereby the general configuration of each of the lock plates 34, 36 is of a substantial C-shape.

Formed at portions of the outer peripheries of the pair of lock plates 34, 36 are locking clicks 44, which come into mesh with the internal gear ratchet wheel 30 when the lock plates 34, 36 move in directions opposite to one another, so that the unwinding rotation of the takeup shaft 22 is stopped, as shown in Figure 5. A pair of pins 46 are projected from one side face of each of the lock plates 34, 36 in parallel with the takeup shaft 22.

Disposed coaxially with the rectangular projection 38 of the takeup shaft 22 is a pivot 48 which is rotated together with the takeup shaft 22. A locking wheel 50 is supported to the pivot 48 in a manner to be rotatable relative to the pivot 48, and four long slots 52 are formed on the face of the locking wheel 50 at the side of the lock plates 34, 36. The pins 46 projected from the respective lock plates 34, 36 are received in the slots 52, so that the pair of lock plates 34, 36 can be moved in directions opposite to each other by a stroke of each of the slots 52.

Also, a torsion coil spring 54 is confined between the locking wheel 50 and the pivot 48, whereby the locking wheel 50 is biased in the clockwise direction relative to the takeup shaft 22, as shown in Figure 4. In consequence, when the takeup shaft 22 is rotated in the unwound direction of the webbing 24 below a predetermined value of acceleration, the locking wheel 50 is subjected to a biasing force of the torsion coil spring 54 to rotate in unison with the takeup shaft 22, following the rotation of the takeup shaft 22. However, when an acceleration of the webbing unwinding rotation of the takeup shaft 22 exceeds the predetermined value, the torsion coil spring 54 is deflected to cause a lag in rotation of the takeup shaft 22. When the lag in rotation occurs, the takeup shaft 22 causes the lock plates 34, 36 to move in the directions opposite to each other, as shown in Figure 5, and during the movement of the lock plates 34, 36 the pins 46 of the lock plates 34, 36 are moved in the slots 52. Thus, locking members for locking the takeup shaft 22 consist substantially of the locking wheel 50, the lock plates 34, 36 and the internal gear ratchet wheel 30.

In addition, during a normal, or ordinary, condition where the takeup shaft 22 does not perform a violent webbing unwinding rotation, the pins 46 of the lock plates 34, 36 abut upon ends of the respective slots 52 at one side and portions of the recesses 40 as being stoppers 40A abut upon the rectangular projection 38 of the takeup shaft 22, as shown in Figure 4.

Formed on the outer periphery of the locking wheel 50 are ratchet teeth 56 which is opposed to a pawl 58 rotatably supported to the leg plate 18. The pawl 58 is pushed up by an inertial ball 62 received in a case 60 mounted on the leg plate 18 to come into mesh with one of the ratchet teeth 56. The pawl 58 is separated from the ratchet teeth 56 due to the self-weight of the pawl 58 in an ordinary running situation of the vehicle, but, when an acceleration of the vehicle reaches a predetermined value, the inertial ball 62 is moved to cause the pawl 58 to come into mesh with one of the ratchet teeth 56, to thereby give a resistant force to the webbing-unwinding directional rotation of the locking wheel 50, which results in lag in rotation of the locking wheel 50 relative to the takeup shaft 22. Thus, the inertial ball 62 functions as an acceleration sensor.

Besides such an inertial body as the above-stated ball, a pendulum, a member falling down at a predetermined acceleration or the like can also be used as the acceleration sensor in the present invention.

Fixed coaxially to the pivot 48 is a pinion 64 which is rotated together with the takeup shaft 22. The pinion 64 is in mesh with another pinion 68 rotatably supported to a cover 66 mounted on to the outer face of the leg plate 18, and the pinion 68 is in mesh with an internal gear 72 of a rotatable ring 70. The rotatable ring 70 is formed with a supporting ring 74 projected coaxially with the rotatable ring 70 in a direction of the cover 60 and is received in an arc convex stripe 76 projected from the cover 66, by which the rotatable ring 70 is supported coaxially with the takeup shaft 22. Thus, the rotation of the takeup shaft 22 is subjected to speed reduction through the pinions 68 and 64 and is transmitted to the rotatable ring 70.

Projected from a portion of the outer periphery of the rotatable ring 70 is an engaging projection 80 which is opposed to one end of an arm 84 pivoted to the leg plate 18 through a pin 82. The other end of the arm 84 is formed with an engaging click 84A which is opposed to the ratchet teeth 56 of the locking wheel 50.

Confined between the arm 84 and the leg plate 18 is a torsion coil spring 86, whereby either the condition shown in Figure 2, i.e. the engaging click 84A being biased in the direction of separation from the ratchet teeth 56, or the condition shown in Figure 7, i.e. the engaging click 84A being biased in the direction of approach to the ratchet teeth 56, can be applied to the arm 84, selectively.

That is to say, in the condition shown in Figure 2 the end of the torsion coil spring 86 fixed to the arm 84 is positioned at the opposite side to the ratchet teeth 56 in the amount of L regarding a line passing the end of the torsion coil spring 86 fixed to the leg plate 18 and the axial center of the pin 82. As a result, the arm 84 is subjected to a biasing force of the torsion coil spring 86 in the direction of separation from the ratchet teeth 56 and is caused to abut on a stopper 88 projected from the leg plate 18, to thereby be stopped.

On the other hand, in the condition shown in Figure 7 the end of the torsion coil spring 86 fixed to the arm 84 is positioned at the side of the ratchet teeth 56 in the amount of M regarding the above-described line. Therefore, the arm 84 is subjected to a biasing force of the torsion coil spring 86 in the direction of approach to the ratchet teeth 56 and is in mesh with the ratchet teeth 56.

Also, the condition of Figure 2 shows the condition that the webbing 24 is wholly wound on to the takeup shaft 22 in its maximum amount, i.e. the

occupant does not wear the webbing 24 but the webbing 24 is stored in the webbing retractor 10. Just before the webbing 24 is put in its stored condition, the engaging projection 80 of the rotatable ring 70 rotating in the direction of an arrow A causes the arm 84 to move from the condition of Figure 7 to the condition of Figure 2 through a boundary point where both the end of the torsion coil spring 84 and the axial center of the pin 82 stand in a line.

In addition, the engaging projection 80 of the rotatable ring 70 is rotated in the direction of an arrow B in accordance with the webbing-unwinding rotation of the takeup shaft 22 and, when the webbing 24 is unwound in its substantially maximum amount, the engaging projection 80 abuts on the reverse side of the projection of the arm 84, i.e. the side reverse to the side shown in Figure 2, as shown in Figure 7, to thereby move the arm 84 from the condition of Figure 2 to the condition of Figure 7. The engaging projection 80 does not contact with the arm 84 while the rotatable ring 70 is rotated from the wholly wound condition of the webbing 24 to the maximum unwound condition thereof.

Description will now be given of operation of the first embodiment according to the present invention.

Figure 2 shows the condition that the webbing 24 is wound on to the takeup shaft 24 in the maximum amount, in which the arm 84 is put in the situation that the engaging click 84A can be biased in the direction of separation from the ratchet teeth 56 by the engaging projection 80 and the locking wheel 50 is put in the situation to be rotatable in accordance with the rotation of the takeup shaft 22.

In consequence, when the occupant unwinds the webbing 24 from the webbing retractor 10 in order to wear it, the locking wheel 50 is rotated in accordance with the rotation of the takeup shaft 22 and the occupant can wear the webbing 24. Thus, the webbing retractor 10 can be used as the ELR.

Accordingly, when the vehicle falls in such an emergency situation as a collision during its running condition, the inertial ball 62 pushes up the pawl 58 and causes it to come into mesh with the ratchet teeth 56 to thereby stop the rotation of the ratchet teeth 56. Simultaneously therewith the occupant wearing the webbing 24 is moved in the direction of the collision by an inertial force, whereby the webbing 24 is unwound to rotate the takeup shaft 22.

However, as the rotation of the locking wheel 50 is stopped, the takeup shaft 22 drives the lock plates 34 and 36 in the opposite directions to each other and causes them to come into mesh with the internal gear ratchet wheel 30, as shown in Figure 5. As a result, the takeup shaft 22 is stopped from rotation in the unwinding direction of the webbing 24, so that the webbing 24 puts the occupant in a restrained situation.

In case that the occupant operates the webbing retractor 10 as the ALR, he only puts the webbing 24 in its maximum unwound situation. In other words, the engaging projection 80 rotated in the direction of the arrow B of Figure 2 by the unwinding of the webbing 24 abuts upon the reverse side of the arm 84 and causes the engaging click 84A to come into mesh with the ratchet wheel 56, as shown in Figure 7. Accordingly, the locking wheel 50 is prevented from rotation in the webbing unwinding direction.

As a result, when the webbing 24 is unwound, the lock plates 34, 36 come into mesh with the internal gear ratchet wheel 30, as shown in Figure 5, so that the unwinding of the webbing 24 is stopped in the same manner as the condition that the pawl 58 is in mesh with the ratchet teeth 56 by the inertial ball 62.

However, since the unwinding of the webbing 24 is stopped, as described above, but the winding thereof can be effected, the webbing retractor 10 functions as a webbing retractor provided with the automatic locking mechanism when an occupant or a baggage wears the webbing 24, so that it restrains the occupant or the baggage surely. Especially, in case that the webbing retractor 10 is operated as the webbing retractor provided with the automatic locking mechanism, the baggage can be restrained securely to the seat by fixing it to the seat with the webbing 24 even in such an small acceleration range that the inertial ball 62 is not worked, so that the baggage does not move on the seat.

Next, the release of the automatic locking mechanism can be conducted by releasing the wearing of the webbing 24 on to the occupant, the baggage or the like and by winding the webbing 24 on to the takeup shaft 22 in its whole amount. That is, the rotatable ring 70 is rotated in the direction of the arrow A shown in Figure 7 in accordance with the webbing-winding rotation of the takeup shaft 22, so that the engaging click 84A is sufficiently separated from the ratchet teeth 56 just before the webbing 24 is wholly wound on to the takeup shaft 22, as shown in Figure 2, and when the end of the torsion coil spring 86 fixed to the arm 84 passes the boundary point the biasing force of the torsion coil spring 86 is reversed. Accordingly, the webbing retractor 10 can be used as the ELR, again.

During the above operation of the webbing 24 the arm 84 does not contact with the engaging projection 80 of the rotatable ring 70 except the whole winding condition of the webbing 24 and the whole unwinding condition thereof. Accordingly, the biasing force of the torsion coil spring 86 is not reversed carelessly and the webbing retractor 10 can be operated reliably.

A second embodiment according to the present invention is described below with reference to Figures 8 through 10.

In the second embodiment a detecting lever 90 is pivoted to the leg plate 18 and is applied to detect the deviation of the amount of the webbing 24 wound on to the takeup shaft 22. The detecting lever 90 is fixed to an axis 92 pivoted to the leg plate 18 and a tip end portion thereof is caused to abut on the outer periphery of the webbing 24 wound in layers on to the takeup shaft 22 by a biasing force of a torsion coil spring 93.

The axis 92 penetrates the leg plate 18 and is fixed to a disk 94 at the outside of the leg plate 18.

Rotatably supported to the disk 94 coaxially therewith is an arm 96, and confined between the arm 96 and the leg plate 18 is a torsion coil spring 86, so that an engaging click 96A formed on a tip portion of the

arm 96 can selectively be biased either in the direction of approach to the ratchet teeth 56 or in the direction of separation therefrom in the same manner as the first embodiment set forth above.

In addition, the disk 94 is projected with a pair of pins 98, 99 at both the sides of the arm 96. The pin 98 is caused to abut on the arm 96, when the webbing 24 is unwound in its whole amount, as shown in Figure 10, and reverses its biasing force to the arm 96 in the direction of approach to the ratchet teeth 56. On the other hand, the pin 99 is caused to abut on the arm 96, when the webbing 24 is wound in its whole amount, and reverses the biasing force to the arm 96 in the direction of separation from the ratchet teeth 56.

Accordingly, the webbing retractor 10 according to the second embodiment can also be used selectively as either the ELR or the ALR in accordance with the deviation of the webbing-unwinding amount.

Next, Figures 11 through 16 show a third embodiment according to the present invention.

In the third embodiment, opposed to the engaging click 84A of the arm 84, instead of the stopper 88 used in the above first embodiment, is one end of a leaf spring 110 which functions as a damping means. That is, the leaf spring 110 is engaged at its central portion with the leg plate 18 through a pin 112 and the other end portion of the leaf spring 110 contrary to the one end opposed to the engaging click 84A is also engaged with the leg plate 18 through a pin 114, whereby the leaf spring 110 reveals a resistant force to an external force acting in such a direction that a norrower angle of the leaf spring 110 between both the end portions of the leaf spring 110 is decreased. Also the one end portion of the leaf spring 110 opposed to the engaging click 84A is engaged with the leg plate 18 through another pin 116, so that the leaf spring 110 reveals a resistant force to an external force acting in the same direction as the above.

In consequence, the engaging click 84A of the arm 84 is rotatable from the condition of Figure 12 in the direction of separation from the ratchet teeth 56 upto the condition of Figure 14, while it is resistant to a biasing force of the leaf spring 110.

In the third embodiment, thus, as the leaf spring 110 constitutes the damping means, the engaging projection 80 pushes up the arm 84 to move, as shown in Figure 14, even though there is dispersion in length of the webbing 24, whereby an unexpected stress does not act upon the engaging projection 80 and the arm 84.

In the third embodiment, mounted on to the outer periphery of the rotatable ring 70 is a frictional ring 118, as shown in Figure 13. The frictional ring 118 is made of a leaf spring material, constitutes a supporting means and is of a substantial C-shape, fastening the outer periphery of the rotatable ring 70 by its elastic force.

The frictional ring 118 is formed at a portion thereof with a L-shaped engaging projection 120 which is opposed to the arm 84. Also, the frictional ring 118 is provided close to the engaging projection 120 with a linear detect projection 122 which is received in a guide groove, not shown, formed on the cover 66. The frictional ring 118 is rotatable along the guide groove of the cover 66 between the condition of Figure 15 and that of Figure 16.

In the condition of Figure 16 situated in a course of the webbing winding rotation, the engaging projection 120 causes the arm 84 to rotate, while it is resistant to the biasing force of the torsion coil spring 86, and separates the engaging click 84A from the ratchet teeth 56. However, the engaging projection 120 does not cause the arm 84 to rotate up to the boundary point shown in Figure 12 where the biasing force of the torsion coil spring 86 is reversed, so that the torsion coil spring 86 maintains a biasing force pushing the engaging click 84A to the ratchet teeth 56.

Accordingly, in case that the webbing 24 is wound largely on to the takeup shaft 22, for example, the occupant releases the wear of the webbing 24, the engaging click 84A is separated from the ratchet teeth 56, whereby noises due to repeated collisions between the engaging click 84A and the ratchet teeth 56 can be prevented from occurring.

Except the above-described construction the third embodiment has the same construction as the first and second embodiments, and, therefore, the former has the substantially same functions and effects as the latters.

The present invention is not limited only to the above-described embodiments but is applicable to all of such control means as being biased in the direction of separation from the locking wheel when the webbing winding amount reaches a predetermined value and being biased in the direction of approach to the locking wheel when the webbing unwinding amount reaches another predetermined value.

CLAIMS

1. A webbing retractor for a seatbelt system for protecting an occupant in an emergency situation comprising:

(a) a takeup shaft winding the webbing;

(b) a locking wheel provided with the takeup shaft;

(c) a locking means locking the locking wheel to prevent the takeup shaft from a webbing-unwinding rotation;

(d) an acceleration sensor biasing the locking means in the direction of the locking wheel only in the emergency situation of the vehicle; and

(e) a control means biased in a direction of separation from the locking wheel when the webbing-winding amount reaches a first predetermined value and biased in a direction of approach to the locking wheel when the webbing unwinding amount reaches a second predetermined value, whereby the unwinding action of the webbing is stopped only in the emergency situation of the vehicle when the webbing winding amount reaches the first predetermined value, and when the webbing unwinding amount reaches the second predetermined value an additional unwinding action of the webbing is stopped.

2. A webbing retractor as claimed in claim 1 in

which the control means is provided with an arm and causes the arm to come into mesh with the locking wheel when the webbing unwinding amount reaches the second predetermined value, and when the webbing winding amount reaches the first predetermined value the control means causes the arm to separate from the locking wheel.

3. A webbing retractor as claimed in claim 2, in which the arm is caused to approach to or separate from the locking wheel urgently when the rotation angle of the arm exceeds a given value.

4. A webbing retractor as claimed in claim 2, in which the arm is caused to approach to or separate from the locking wheel urgently by a reverse of a biasing force of an elastic body when the arm passes a boundary point.

5. A webbing retractor as claimed in claim 4, in which the arm is pivoted to a leg plate supporting the takeup shaft, and the biasing force of the elastic body is reversed in accordance with whether or not a point of the arm fixed to the elastic body is positioned to a side of the locking wheel relative to a line passing through a point of the elastic body supported to the leg plate and an axial center of the arm pivoted to the leg plate.

6. A webbing retractor as claimed in claim 1, in which the control means is controlled to its situations of approach to and of separation from the locking wheel in response to the number of rotation of the takeup shaft.

7. A webbing retractor as claimed in claim 2, in which the arm is controlled to its situations of engagement with and of separation from the locking wheel in response to the number of rotation of the takeup shaft.

8. A webbing retractor as claimed in claim 7, in which the rotation of the takeup shaft is reduced through a combination of a plurality of gears, whereby the rotation of the arm is controlled.

9. A webbing retractor as claimed in claim 2, in which the rotation of the takeup shaft is subjected to reduction to be transmitted to a rotatable ring and the arm is controlled by the rotatable ring in accordance with the unwinding and winding actions of the first and second predetermined amounts of the webbing.

10. A webbing retractor as claimed in claim 9, in which the rotatable ring is formed with an engaging projection, which is opposed to the arm.

11. A webbing retractor as claimed in claim 10, wherein, when the arm is biased in the direction of separation from the locking wheel, the arm is movable in a slight amount in the direction of separation from the locking wheel while it is being subjected to a resistant force, whereby an overstroke of the rotatable ring is absorbed.

12. A webbing retractor as claimed in claim 2, wherein the arm is caused to separate from the locking wheel when the webbing is wound in an amount of more than the first predetermined value, whereby noises due to collisions between the arm and the locking wheel are prevented from occurring.

13. A webbing retractor as claimed in claim 9, wherein the rotatable ring is provided with a frictional ring through a frictional force occuring therebetween, and the frictional ring is formed with an engaging projection which is opposed to the arm and causes the arm to separate from the locking wheel at the time of a winding action of the webbing.

14. A webbing retractor as claimed in claim 1, wherein the control means is controlled to its situations of approach to and of separation from the locking wheel in response to a diameter of the webbing wound on to the takeup shaft.

15. A webbing retractor as claimed in claim 4, wherein the control means is provided with a detecting lever, one end thereof being caused to contact with an outer periphery of the webbing wound on to the takeup shaft, the arm contacting with and separating from the locking wheel and a reversing means causing the arm to approach with and separate from the locking wheel in response to a rotation angle of the detecting lever.

16. A webbing retractor as claimed in claim 15, wherein the arm is pivoted to a leg plate supporting the takeup shaft, and the biasing force of the eleastic body is reversed in accordance with whether or not a point of the arm fixed to the elastic body is positioned to a side of the locking wheel relative to a line passing through a point of the elastic body supported to the leg plate and an axial center of the arm pivoted to the leg plate.

17. A webbing retractor used in a seatbelt system for a vehicle, comprising:

(a) a frame fixed to the vehicle body;

(b) a takeup shaft rotatably supported to the frame;

(c) a locking wheel rotatably supported coaxially with the takeup shaft;

(d) a locking means preventing the takeup shaft from rotating in a webbing-unwinding direction due to lag in rotation of the locking wheel relative to the takeup shaft;

(e) an acceleration sensor biasing the locking means in the direction of the locking wheel only in an emergency situation of the vehicle;

(f) an arm pivoted to the frame and opposed to the locking wheel;

(g) a reversing means biasing the arm in directions of approach to and of separation from the locking wheel when the arm rotatably passes a boundary point; and

(h) a control means, thereto a rotation of the takeup shaft being subjected to reduction to be transmitted, causing the arm to approach to the locking wheel when the webbing is wound in an amount of more than a predetermined value and causing the arm to separate from the locking wheel when the webbing is unwound in an amount of more than another predetermined value.

18. A webbing retractor as claimed in claim 17, wherein the control means has a gear connected to the takeup shaft and an internal gear, thereto a rotation of the gear being transmitted.

19. A webbing retractor used in a seatbelt system for a vehicle, comprising:

(a) a frame fixed to the vehicle body;

(b) a takeup shaft rotatably supported to the frame;

(c) a locking wheel rotatably supported coaxially

with the takeup shaft;

(d) a locking means preventing the takeup shaft from rotating in a webbing unwinding direction due to lag in rotation of the locking wheel relative to the takeup shaft;

(e) an acceleration sensor biasing the locking means in the direction of the locking wheel in an emergency situation of the vehicle;

(f) an arm pivoted to the frame and opposed to the locking wheel;

(g) a reversing means biasing the arm in directions of approach to and of separation from the locking wheel when the arm passes a boundary point; and

(h) a control means causing the arm to approach to the locking wheel, when the outer diameter of the webbing wound on to the takeup shaft is less than a predetermined amount, and causing the arm to separate from the locking wheel, when the outer diameter of the webbing wound on to the takeup shaft reaches the predetermined amount.

20. A webbing retractor as claimed in claim 19, wherein the control means is provided with a detecting lever, one end thereof being caused to contact with an outer periphery of the webbing wound on to the takeup shaft, the arm contacting with and separating from the locking wheel and a reversing means causing the arm to approach with and separate from the locking wheel in response to a rotation angle of the detecting lever.

21. A webbing retractor for a seatbelt system for protecting an occupant in an emergency situation substantially as herein described with reference to and as illustrated in any one of the accompanying drawings.

22. A vehicle whenever fitted with a webbing retractor as claimed in claim 1.

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